

# Emission and Air Quality Trends Review

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## Nevada

May 2013

# Project Objective

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- To develop and present publicly available information on trends in emissions and ambient air quality in the U.S. since 1999 in easy to understand visual and tabular formats

# Emission Trends

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- Study Team collected and processed U.S. EPA emission inventories for years within the study period of interest (1999-2011)
  
- By pollutant and source category
  - electric generation fuel combustion
  - mobile sources
  - industrial fuel combustion & industrial processes
  - all other

# Emissions Data Summary

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- Data Obtained from EPA National Emission Inventory (NEI) and Trends Websites
  - EPA's Trends reports and emission comparisons include interpolations of all categories between key years (1999, 2002, 2005, 2008, 2011) at county-pollutant level
  - Represented Pollutants: VOC, NO<sub>x</sub>, SO<sub>2</sub>, and PM<sub>2.5</sub>
- Project Improvement
  - The Study Team augmented above data with year specific CEM emissions (2002 through 2011)

# Emission Changes

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- ❑ The following slides also include the tonnage-based emissions change from 1999 to 2011 for each pollutant
- ❑ Negative values indicate decrease in emissions, positive values indicate an increase

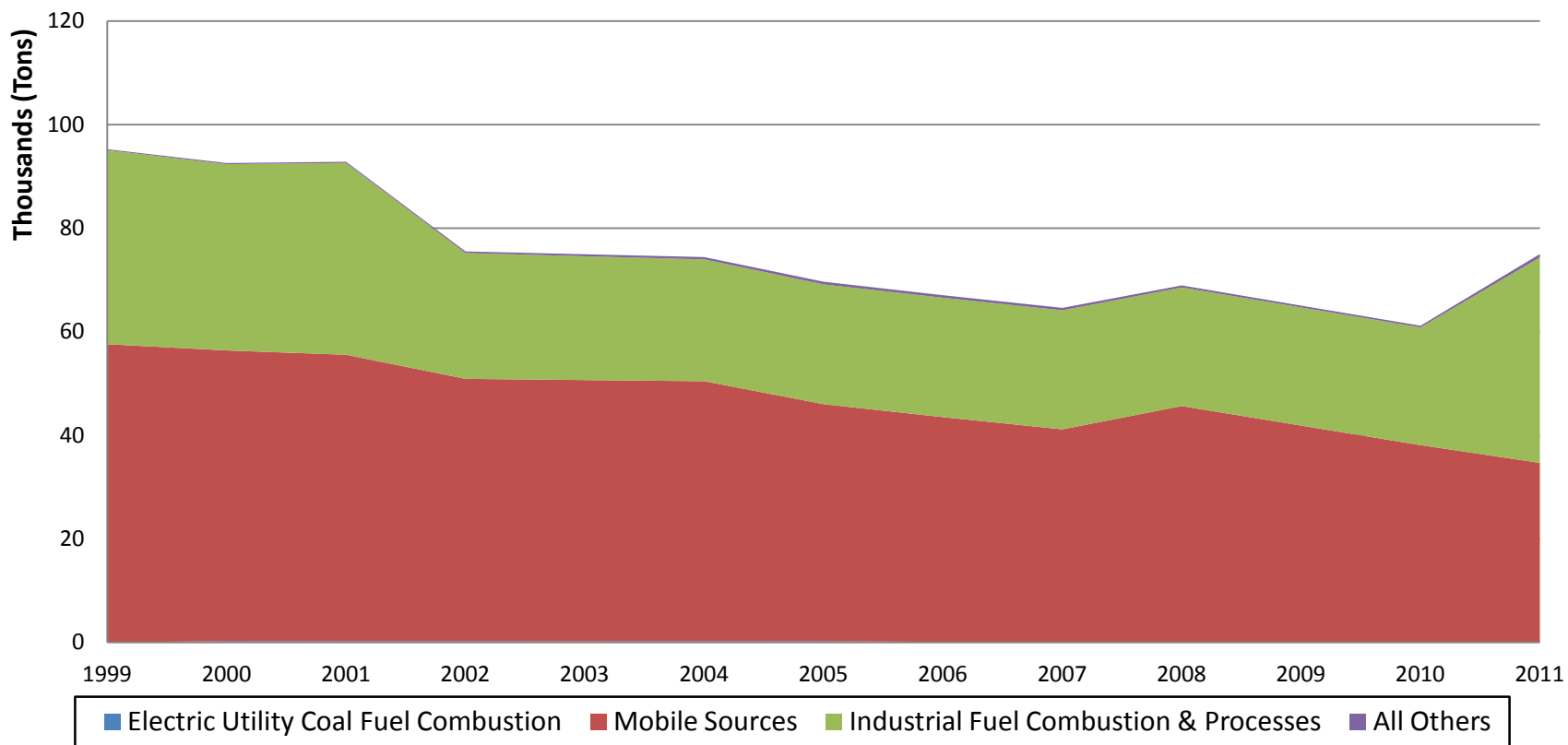
# Nevada Emission Trends (VOC)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0	245	234	247	93	89	77	73	66	72
Mobile Sources	57,590	55,307	50,430	45,763	43,413	41,063	45,567	41,801	38,035	34,600
Industrial Fuel Combustion & Processes	37,486	37,045	23,909	23,136	23,058	22,986	22,907	22,819	22,739	39,673
All Others	172	230	386	509	486	466	392	346	317	656
<b>Total</b>	<b>95,248</b>	<b>92,827</b>	<b>74,959</b>	<b>69,655</b>	<b>67,050</b>	<b>64,604</b>	<b>68,944</b>	<b>65,039</b>	<b>61,158</b>	<b>75,001</b>

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Mobile Sources	0%	-4%	-12%	-21%	-25%	-29%	-21%	-27%	-34%	-40%
Industrial Fuel Combustion & Processes	0%	-1%	-36%	-38%	-38%	-39%	-39%	-39%	-39%	6%
All Others	0%	34%	125%	196%	183%	171%	128%	101%	84%	281%
<b>Total</b>	<b>0%</b>	<b>-3%</b>	<b>-21%</b>	<b>-27%</b>	<b>-30%</b>	<b>-32%</b>	<b>-28%</b>	<b>-32%</b>	<b>-36%</b>	<b>-21%</b>

# Nevada Emission Trends (VOC)

**Major Source Category Summary  
Annual VOC Emissions**



# Nevada Emission Trends (NO<sub>x</sub>)

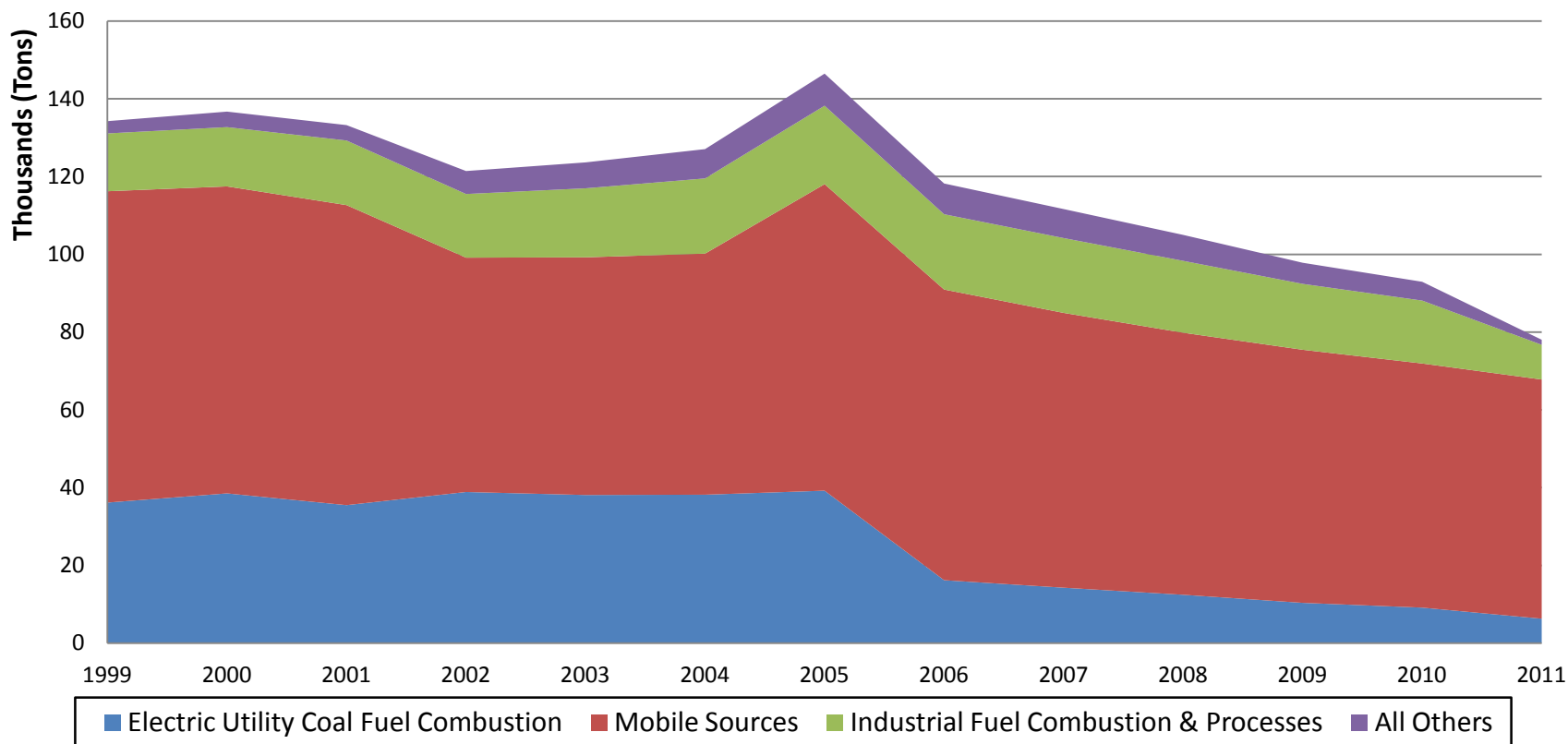
Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	36,154	35,493	38,098	39,212	16,186	14,257	12,439	10,360	9,132	6,286
Mobile Sources	80,077	77,172	61,136	78,843	74,764	70,685	67,404	65,100	62,797	61,515
Industrial Fuel Combustion & Processes	14,874	16,613	17,751	20,175	19,365	19,246	18,485	16,945	16,182	8,935
All Others	3,157	3,960	6,665	8,247	7,905	7,460	6,674	5,430	4,832	1,294
<b>Total</b>	<b>134,261</b>	<b>133,239</b>	<b>123,650</b>	<b>146,477</b>	<b>118,220</b>	<b>111,647</b>	<b>105,001</b>	<b>97,835</b>	<b>92,942</b>	<b>78,031</b>

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	-2%	5%	8%	-55%	-61%	-66%	-71%	-75%	-83%
Mobile Sources	0%	-4%	-24%	-2%	-7%	-12%	-16%	-19%	-22%	-23%
Industrial Fuel Combustion & Processes	0%	12%	19%	36%	30%	29%	24%	14%	9%	-40%
All Others	0%	25%	111%	161%	150%	136%	111%	72%	53%	-59%
<b>Total</b>	<b>0%</b>	<b>-1%</b>	<b>-8%</b>	<b>9%</b>	<b>-12%</b>	<b>-17%</b>	<b>-22%</b>	<b>-27%</b>	<b>-31%</b>	<b>-42%</b>



# Nevada Emission Trends (NO<sub>x</sub>)

**Major Source Category Summary  
Annual NO<sub>x</sub> Emissions**



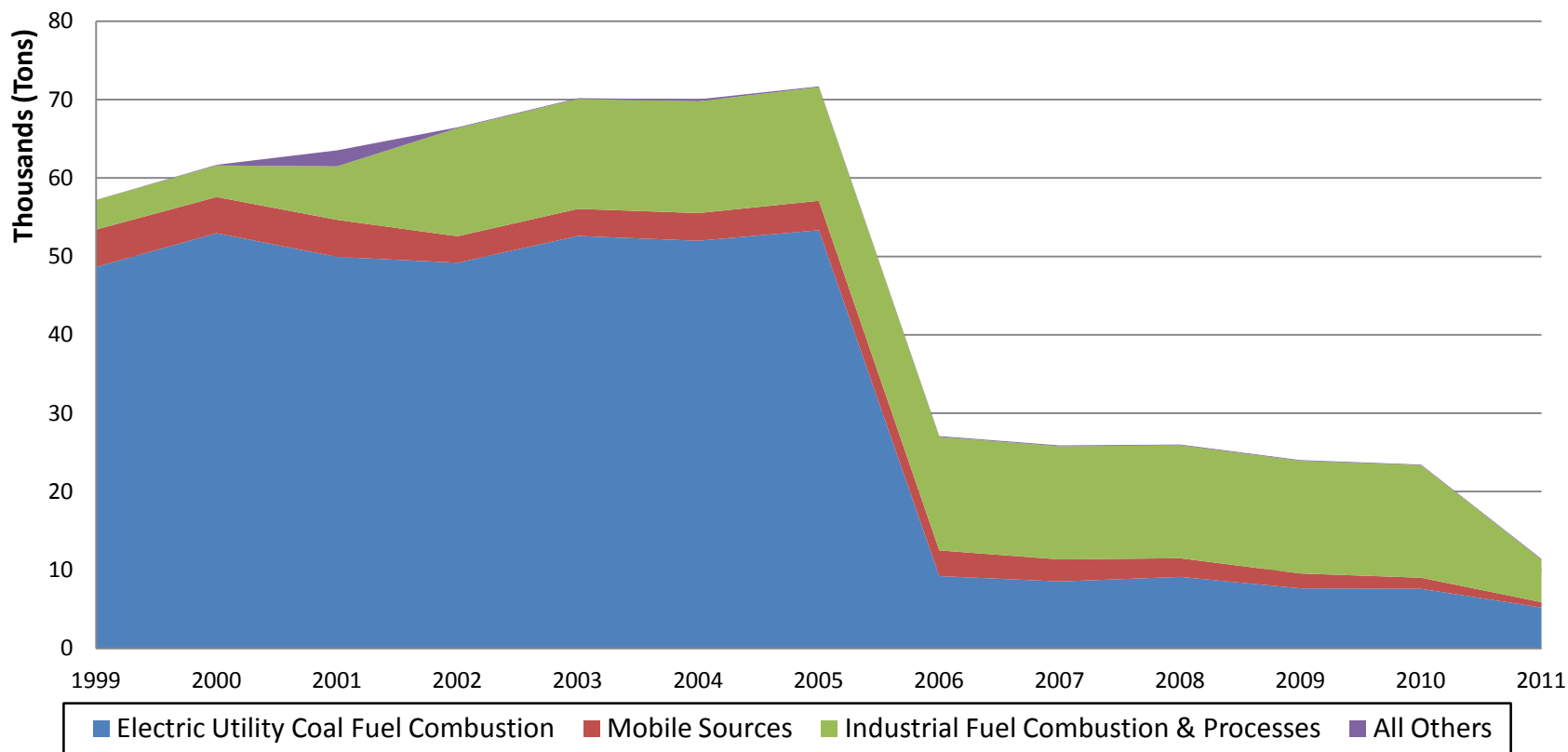
# Nevada Emission Trends (SO<sub>2</sub>)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	48,661	49,940	52,615	53,352	9,227	8,546	9,127	7,662	7,603	5,225
Mobile Sources	4,768	4,726	3,452	3,745	3,278	2,811	2,380	1,898	1,416	674
Industrial Fuel Combustion & Processes	3,770	6,827	14,032	14,493	14,476	14,433	14,403	14,375	14,349	5,433
All Others	21	2,039	84	102	106	106	98	88	82	90
<b>Total</b>	<b>57,220</b>	<b>63,533</b>	<b>70,183</b>	<b>71,691</b>	<b>27,087</b>	<b>25,896</b>	<b>26,007</b>	<b>24,023</b>	<b>23,450</b>	<b>11,422</b>

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	3%	8%	10%	-81%	-82%	-81%	-84%	-84%	-89%
Mobile Sources	0%	-1%	-28%	-21%	-31%	-41%	-50%	-60%	-70%	-86%
Industrial Fuel Combustion & Processes	0%	81%	272%	284%	284%	283%	282%	281%	281%	44%
All Others	0%	9565%	298%	382%	400%	402%	363%	317%	287%	327%
<b>Total</b>	<b>0%</b>	<b>11%</b>	<b>23%</b>	<b>25%</b>	<b>-53%</b>	<b>-55%</b>	<b>-55%</b>	<b>-58%</b>	<b>-59%</b>	<b>-80%</b>

# Nevada Emission Trends (SO<sub>2</sub>)

**Major Source Category Summary  
Annual SO<sub>2</sub> Emissions**



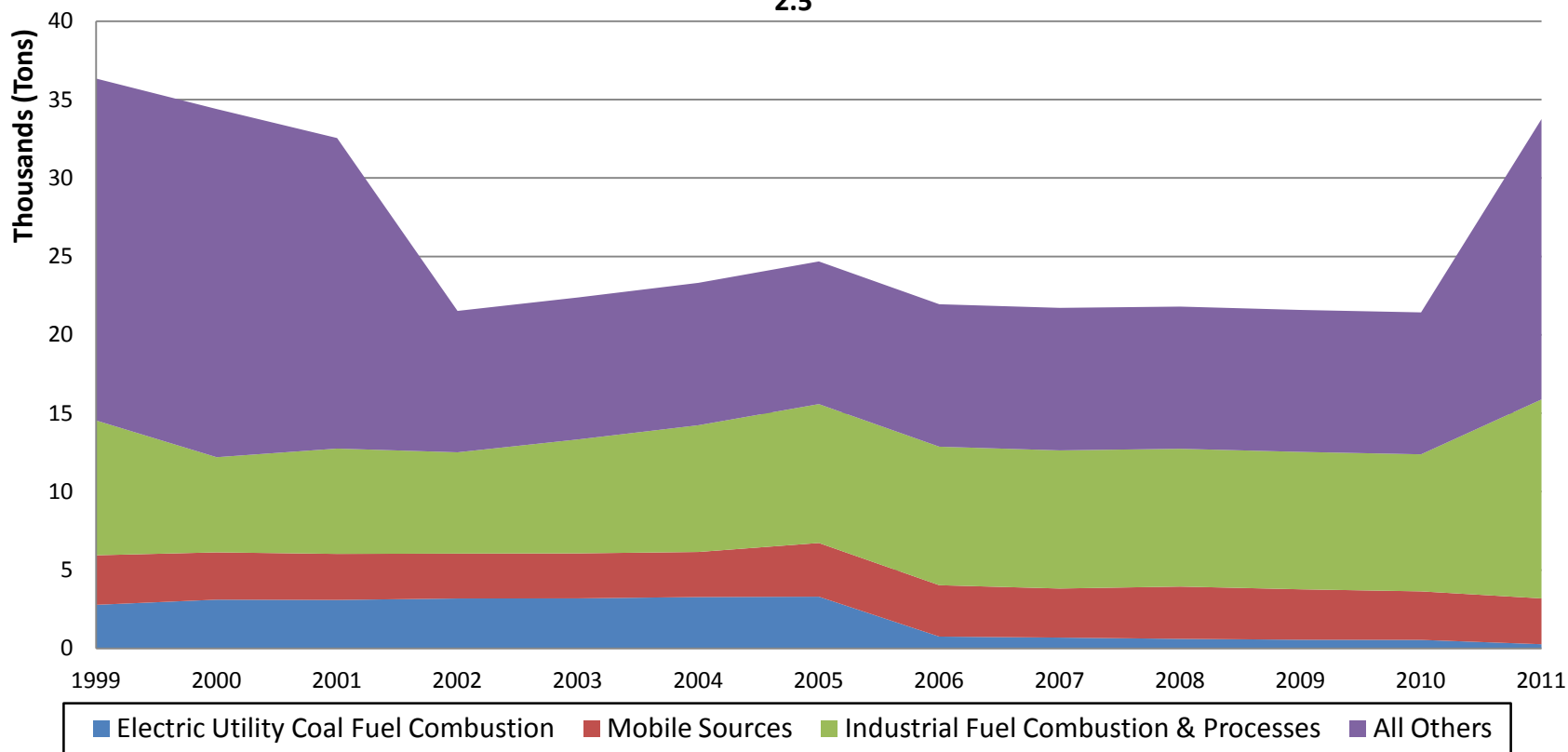
# Nevada Emission Trends (PM<sub>2.5</sub>)

Source Category	Annual Emissions (Tons)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	2,782	3,093	3,194	3,301	756	691	610	555	545	268
Mobile Sources	3,159	2,935	2,869	3,425	3,277	3,129	3,336	3,216	3,096	2,923
Industrial Fuel Combustion & Processes	8,597	6,718	7,267	8,858	8,834	8,811	8,787	8,763	8,740	12,688
All Others	21,804	19,804	9,054	9,098	9,084	9,089	9,068	9,054	9,051	17,880
<b>Total</b>	<b>36,342</b>	<b>32,550</b>	<b>22,383</b>	<b>24,682</b>	<b>21,951</b>	<b>21,720</b>	<b>21,801</b>	<b>21,588</b>	<b>21,432</b>	<b>33,759</b>

Source Category	Annual Emissions Change (Percent since 1999)									
	1999	2001	2003	2005	2006	2007	2008	2009	2010	2011
Electric Utility Coal Fuel Combustion	0%	11%	15%	19%	-73%	-75%	-78%	-80%	-80%	-90%
Mobile Sources	0%	-7%	-9%	8%	4%	-1%	6%	2%	-2%	-7%
Industrial Fuel Combustion & Processes	0%	-22%	-15%	3%	3%	2%	2%	2%	2%	48%
All Others	0%	-9%	-58%	-58%	-58%	-58%	-58%	-58%	-58%	-18%
<b>Total</b>	<b>0%</b>	<b>-10%</b>	<b>-38%</b>	<b>-32%</b>	<b>-40%</b>	<b>-40%</b>	<b>-40%</b>	<b>-41%</b>	<b>-41%</b>	<b>-7%</b>

# Nevada Emission Trends (PM<sub>2.5</sub>)

**Major Source Category Summary  
Annual PM<sub>2.5</sub> Emissions**



# Emission Trends Summary

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- ❑ All pollutants have decreased since 1999 in aggregate across Nevada
- ❑ NO<sub>x</sub> and SO<sub>2</sub> from Electric Utility Fuel Combustion sources show decrease over time as a result of participation in the Acid Rain Program
- ❑ Onroad emission step increase seen between 2004 and 2005 is the result of EPA's method change and MOVES model integration for estimating onroad mobile source emissions

# Air Quality Design Values

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## □ Ozone

- Annual 4<sup>th</sup> highest daily maximum 8-hour average averaged over three consecutive years
- Current standard = 0.075 ppm

## □ PM<sub>2.5</sub> Annual

- Annual arithmetic mean of quarterly means averaged over three consecutive years
- Current standard = 12 ug/m<sup>3</sup>

## □ PM<sub>2.5</sub> 24-Hour

- Annual 98<sup>th</sup> percentile of daily averages averaged over three consecutive years
- Current standard = 35 ug/m<sup>3</sup>

# State-Wide Design Value (DV) Trends

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- Trends in state-wide maximum DV and average DV
  - Max DV: Maximum DVs over all valid trend monitoring sites in the state in each overlapping three year period
  - Average DV: Average of DVs over all valid trend monitoring sites in the state in each overlapping three year period
- Compute linear trend via least-squares regression



# Data Handling Procedures

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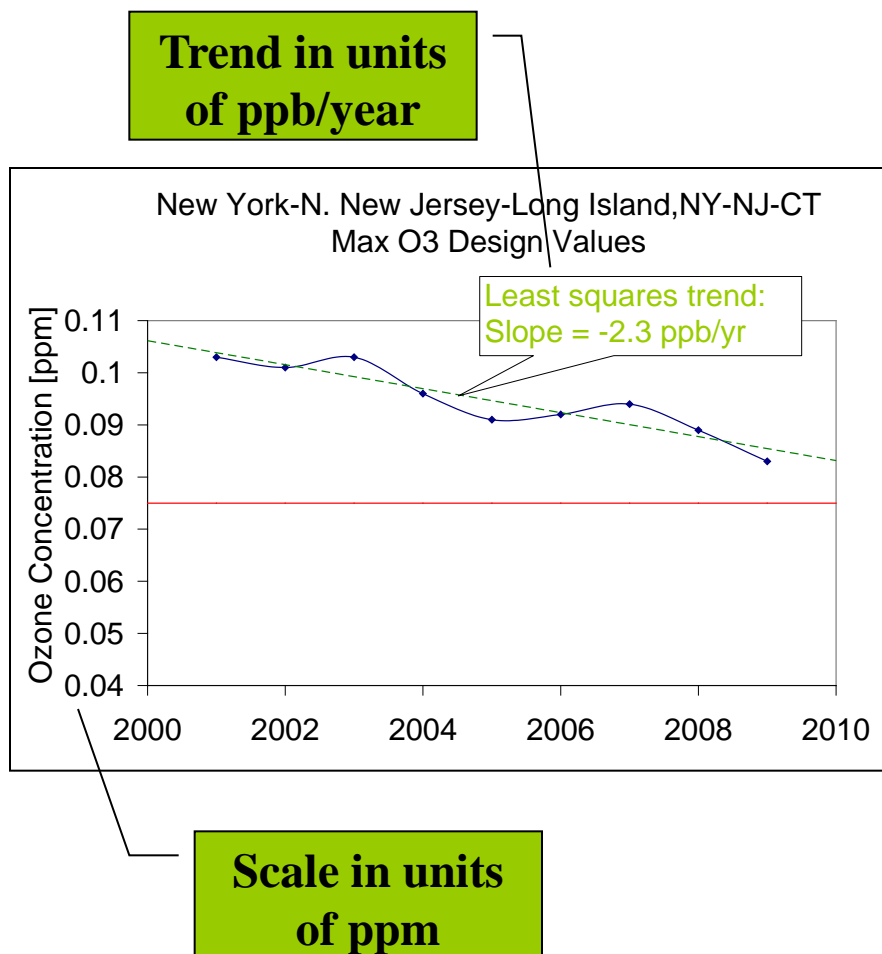
- O<sub>3</sub> design value (DV) for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculated using annual 4<sup>th</sup> highest daily max 8-hr averages and percent of valid observations, based on EPA data handling conventions
  - Data associated with exceptional events that have received EPA concurrence are omitted
  - Selection of trend sites require valid DV in 9 out of 11 three-year periods between 1999 and 2011
  - Identification of nonattainment areas is with respect to the 2008 8-hour standard only

# Data Handling Procedures

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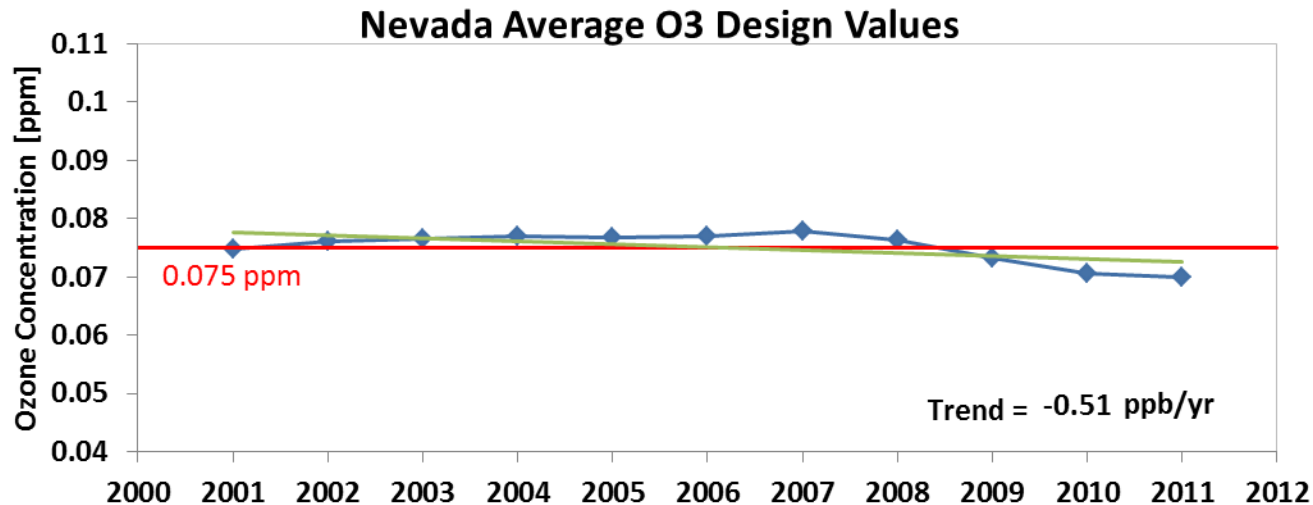
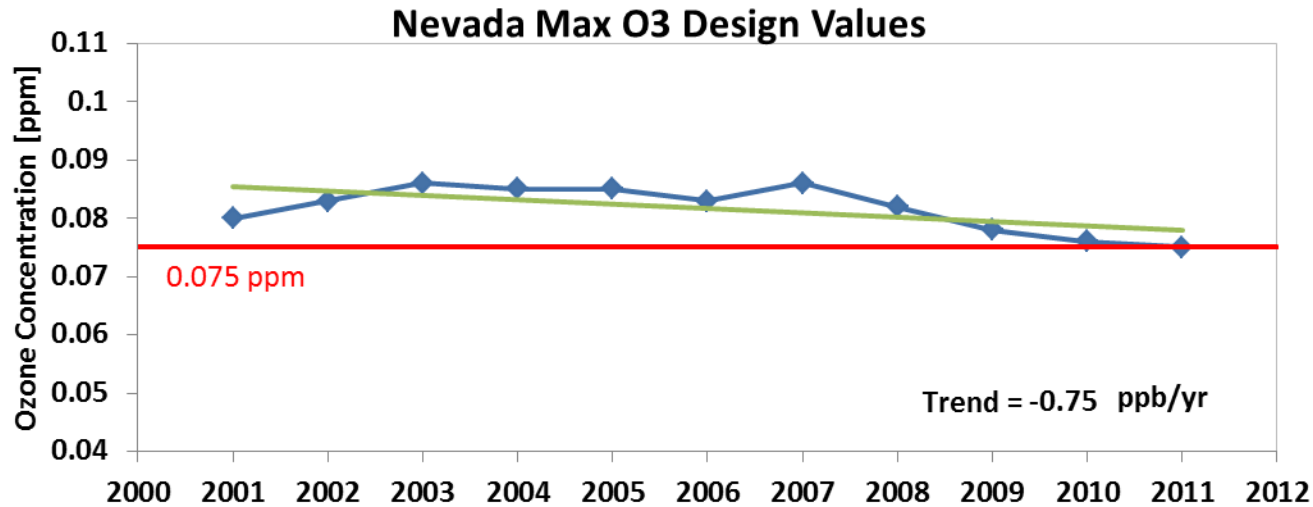
- Annual  $PM_{2.5}$  DV and 24-hr  $PM_{2.5}$  DV for each overlapping three-year period starting with 1999-2001 and ending with 2009-2011
  - DV calculations based on EPA data handling conventions
  - Data extracted from monitors that have a non-regulatory monitoring type are omitted
  - Selection of trend sites require valid DV in 9 out of 11 three-year periods between 1999 and 2011

# Trend Calculation



- Trends based on linear least squares fit to rolling three year design values (DVs)
- Negative trend indicates improving air quality
- DVs based on each 3-year period: 1999-2001, 2000-2002, ... 2009-2011
- Notes
  - On plots, DVs are for three year period ending in year shown (i.e., 2009-2011 DV plotted as 2011 value)
  - Ozone trend values expressed as ppb/year (1,000 ppb = 1 ppm); DVs are plotted as ppm

# Max/Ave O<sub>3</sub> DVs and Trend



# Ozone Trends by Site in Nevada

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3200300204420101	Clark, NV	N/A	0.17
3200300224420101	Clark, NV	N/A	-0.37
3200300434420101	Clark, NV	0.073	-0.33
3200300714420101	Clark, NV	0.074	-0.54
3200300724420101	Clark, NV	N/A	-0.27
3200300734420101	Clark, NV	0.073	-0.77
3200300754420101	Clark, NV	0.075	-1.15
3200305384420102	Clark, NV	0.07	-0.57

Note: Only monitoring sites meeting data completeness criteria listed

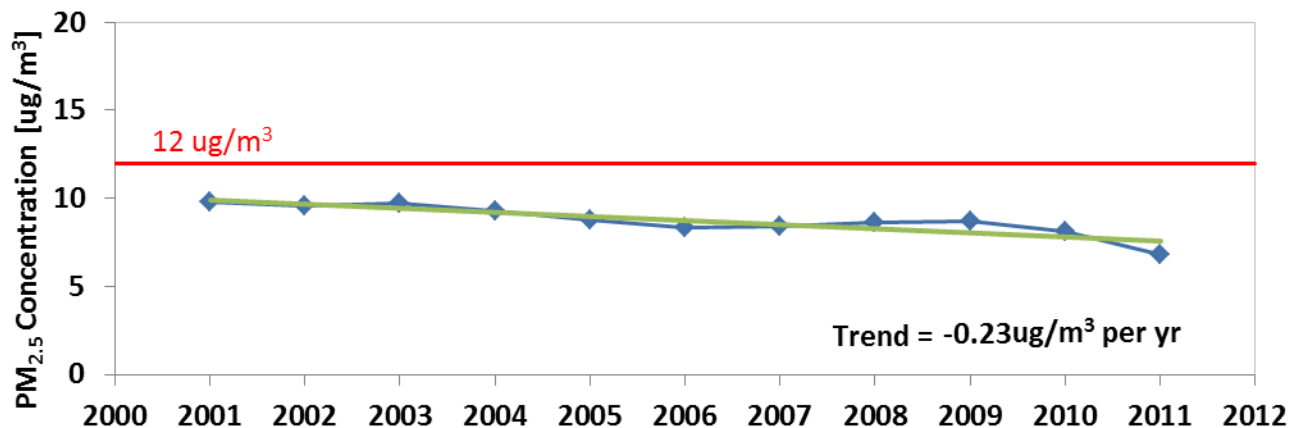
# Ozone Trends by Site in Nevada

Monitoring Sites	County	2009-2011 DV [ppm]	Trend [ppm/yr]
3200306014420101	Clark, NV	N/A	-0.22
3200310194420101	Clark, NV	0.073	-0.76
3200320024420101	Clark, NV	0.07	-0.55
3203100164420101	Washoe, NV	0.064	-0.32
3203100204420101	Washoe, NV	0.065	-0.87
3203110054420101	Washoe, NV	0.066	-0.51
3203120094420101	Washoe, NV	0.066	0.64
3203301014420101	White Pine, NV	0.07	-0.16

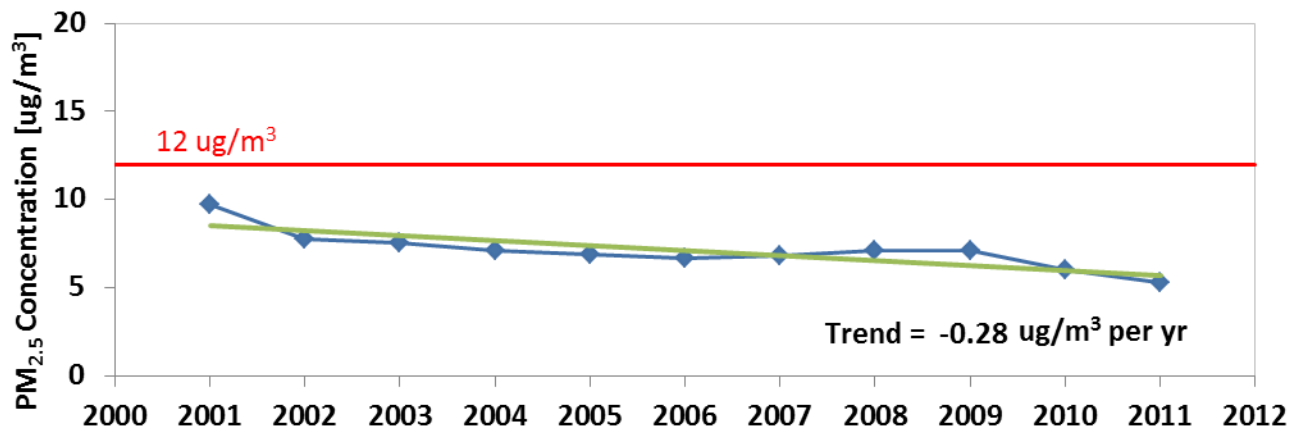
Note: Only monitoring sites meeting data completeness criteria listed

# Max/Ave PM<sub>2.5</sub> Annual DVs and Trend

## Nevada Max PM<sub>2.5</sub> Annual Design Values

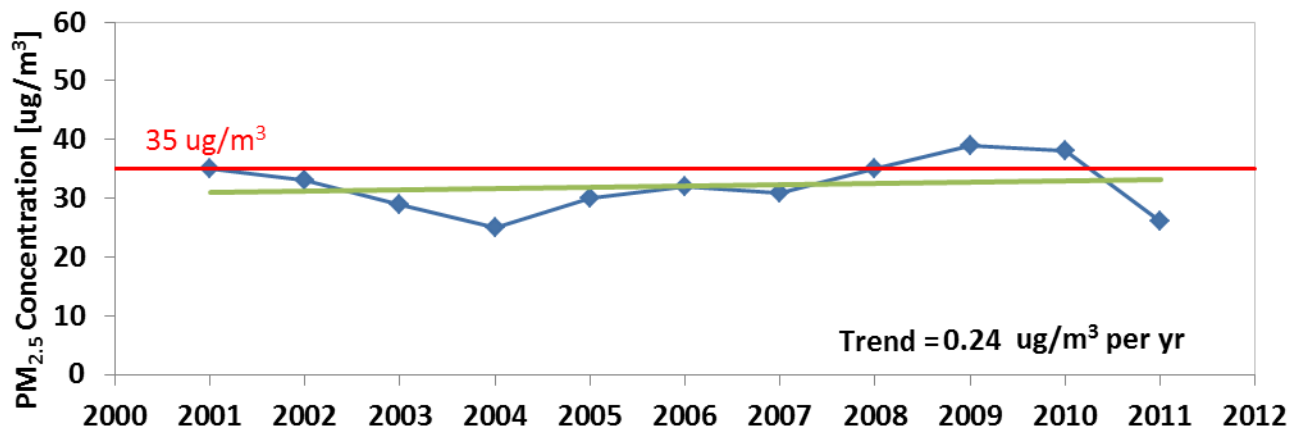


## Nevada Average PM<sub>2.5</sub> Annual Design Values

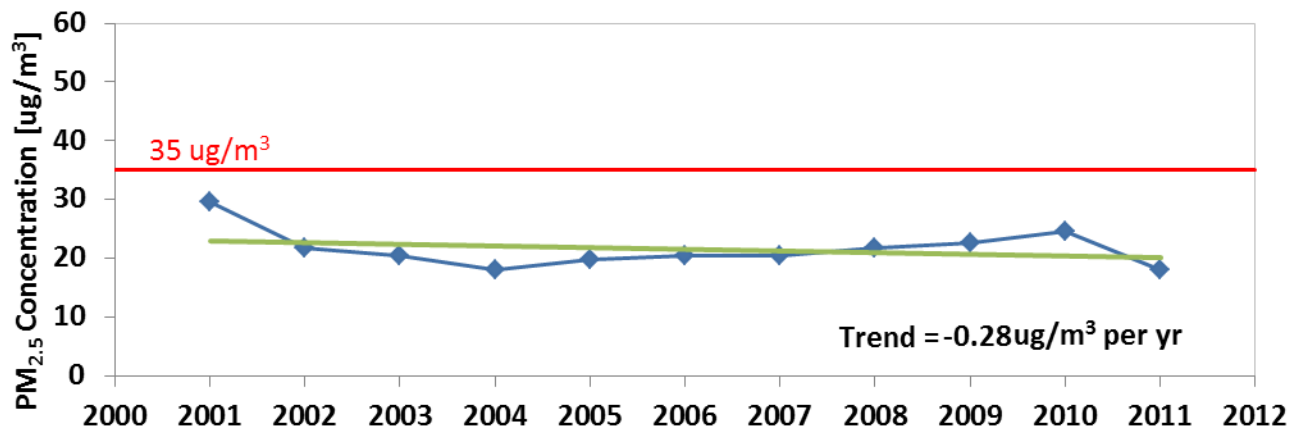


# Max/Ave PM<sub>2.5</sub> 24-Hour DVs and Trend

Nevada Max PM<sub>2.5</sub> 24-Hour Design Values



Nevada Average PM<sub>2.5</sub> 24-Hour Design Values





# PM<sub>2.5</sub> Trends by Site in Nevada

Monitoring Site	County	2009-2011 DV [ug/m <sup>3</sup> ]		Trend [ug/m <sup>3</sup> per year]	
		Annual	24-Hr	Annual DV	24-Hr DV
320031019	Clark	3.7	10	-0.01	0.15
320032002	Clark	N/A	N/A	-0.20	-0.52
320310016	Washoe	6.8	26	-0.18	0.24

Note: Only monitoring sites meeting data completeness criteria listed

# Air Quality Trends Summary

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- Average O<sub>3</sub> and 24-hr PM<sub>2.5</sub> design values have remained steady since 1999 in Nevada. Average annual PM<sub>2.5</sub> design values have decreased since 1999 in Nevada.
- There are no currently designated O<sub>3</sub> or PM<sub>2.5</sub> non-attainment areas in Nevada.